METHOD AND DEVICE FOR MEASURING HEART RATE, AND METHOD FOR MANUFACTURING THE DEVICE

FIELD

[0001] The invention relates to a measuring device and a measuring method arranged to measure non-invasively the heart function of a user on whose hand the measuring device has been attached.

BACKGROUND

[0002] Heart rate measurement is based on monitoring the function of the heart. When the heart contracts it causes a series of electric impulses that can be measured in the body. The measurement and analysis of this signal is called electrocardiography (EKG), and the signal itself is known as an EKG signal. Different phases of the heart cycle can be distinguished in the signal.

[0003] Heart rate can be measured with a measuring device similar to a wristwatch, for example, the device measuring an EKG signal from the user's hands. The measuring device comprises a measuring unit that may contain for example an electronic signal processing unit for processing the EKG signal, a display, a user interface, and a wristband portion for attaching the measuring device to the user's hand. The inner measuring device surface that sets against the hand is provided with one or more electrodes, each one of which is in contact with the skin and connected to the signal processing unit of the measuring unit. The measuring unit further comprises a second electrode on the outer surface of the measuring device. This electrode is also connected to the signal processing unit, and to produce a contact with the electrode, the user must touch it with one finger of his/her other hand. With each hand thus in contact with a separate electrode, the signal processing unit is capable of measuring and processing the EKG signal transmitted by the electrodes.

[0004] However, this kind of measurement involves a number of problems. When the measuring device is touched with one hand, also the hand to which the measuring device is attached is pressed. The forces acting between the hands thus vary considerably, particularly during motion, which impairs the measurement contact, the quality of the detected EKG signal, and thereby also the measurement result. Moreover, it is difficult to keep the finger on the small electrode of the measuring device, and occasionally the contact may be lost, which further impairs the measurement and may even cause it to fail. A lateral hand movement in particular causes motion-related disturbance in a signal.

BRIEF DESCRIPTION

[0005] It is an object of the invention to provide an improved measuring device, a manufacturing method thereof, and a measuring method to allow a more reliable measuring device and measuring to be obtained.

[0006] This is achieved by a heart rate measuring device to be attached around a user's hand, the device comprising: attaching means which are fixed to the measuring unit; an inner surface arranged to be in contact with the skin of the hand to which the device is attached; an outer surface, i.e. a surface other than the inner surface; an electrically conductive inner structure provided on the inner surface of the measuring device and functioning as an electrode for a contact with the skin of the hand to which the device is attached; an electrically conductive outer structure functioning as an electrode for a contact with the user's other hand and electrically isolated from the electrically conductive inner structure; a measuring unit to which the electrically conductive outer structure and inner structure are connected for heart rate measurement. The device is characterized in that: the electrically conductive outer structure of the measuring device extends at least to opposite sides of the hand to which the device is attached; the electrically conductive outer structure comprises at least one electrode on the outer surface of the measuring device, on opposite sides of the hand to which the measuring device is attached, which at least one electrode the user is to touch with separate fingers of his/her other hand from opposite directions of the hand to which the device is attached; and the at least one electrode is connected to the measuring unit with a wire inside the wristband.

[0007] The invention further relates to a method for manufacturing a heart rate measuring device to be attached around a user's hand with attaching means which are fixed to the measuring unit; the method comprising: providing an electrically conductive inner structure on an inner surface of the measuring device, the inner surface being in contact with the skin of the hand to which the device is attached and at least part of the electrically conductive inner structure being meant to function as an electrode for the skin contact with the hand to which the device is attached; providing an electrically conductive outer structure on an outer surface of the measuring device to provide an electrode for a contact with the user's other hand, the electrically conductive outer structure being electrically isolated from the electrically conductive inner structure, the outer surface referring to a measuring device surface other than the inner surface; providing a measuring unit with signal processing means; and connecting the electrically conductive outer structure and inner structure to the signal processing means of the measuring unit for heart rate measurement. The method further comprises: producing at least one electrode of the electrically conductive outer structure on the outer surface of the measuring device, on opposite sides of the hand to which the device is attached; and connecting the electrode to the measuring unit with a wire inside the wristband.

[0008] The invention still further relates to a method for measuring heart rate, in which method a measuring device is attached around a user's hand, the method comprising: bringing the user's hand to which the measuring device is attached into contact with an electrically conductive inner structure provided on an inner surface of the measuring device that sets against the skin of the hand to which the device is attached; bringing the user's other hand into contact with the device as the user touches with his/her other hand an electrically conductive outer structure provided on the outer surface of the measuring device on the hand to which it is attached, the outer surface referring to a measuring device surface other than the inner surface; and connecting heart rate from the separate hands of the user via the electrically conductive outer structure and inner structure to the measuring unit for heart rate measurement. The method further comprises: bringing the user's other hand into contact with the device by having the user touch with the fingers of his/her other hand at least one electrode of the